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The Official Journal of the Rocks and Minerals Association

Chips from the Quarry

PETER ZODAC

WHAT'S WRONG WITH MINERAL COLLECTING?

ROCKS AND MINERALS has been in existance for 12 years during which time it has printed many fine articles on mineral collecting; has seen many clubs organized; many field trips made to noted localities; and a large number of people become interested in minerals. As the proof of the pudding is in the eating, we naturally would assume that all of these activities would result in the making of many fine mineral collections, some of which would be outstanding. The results, however, are anything but satisfactory. When we think of the many "collections" we have seen in which slags from iron furnaces were labeled as "meteorites", chips of colored bottle glass as "obsidians", weathered bones as "petrified woods" and other glaring inaccuracies,—not forgetting the motley arrays of dirty boulders, cobble stones and chips from ledge rock—all classified as "mineral collections", we are forced to realize that something is wrong somewhere.

During the past few months we have been making a survey of these conditions and the point has been brought out, of which we were conscious for sometime, that the average collector, and by average we mean about 90% of all those collecting, have a false impression as to what a mineral collection really is. His creed is—"I won't buy any specimens but collect them myself at localities. It is more fun to collect them personally and they won't cost me anything either."

Some mineral clubs are the worst offenders in the dissemination of this false doctrine. Instead of urging its members to strive for good collections of fine minerals where beauty of color, perfection of crystals, accuracy in labeling and nicely displayed, should be of prime importance so that such collections should be of value, and of wonderment to all who view them, the club's motto seems to be—TAKE ANYTHING AS LONG AS IT DOESN'T COST YOU A CENT. When a club is made up of uninformed amateur collectors whose minds are being permeated with this idea, the members naturally will do little or no buying of mineral specimens. Instead they will rush off at their first opportunity to any mine or quarry brought to their attention with the idea in mind that every *mass, chip and fragment* on the dumps is of excellent quality and valuable (not realizing that if this was so the thousands of tons of the material there present would never have been discarded or

(Continued on page 151)

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GRAVES MOUNTAIN, GEORGIA

By PETER ZODAC

Editor Rocks and Minerals

To our mind, Graves Mountain is the most interesting locality in Georgia. We had long known of its existance as the source for the finest rutile crystals in the world and it was one of the few localities on our preferred list as being worthy of a visit. Therefore, when a trip through the southern states was contemplated during the early spring of 1938, Graves Mountain was the first locality to be placed upon our itinerary.

Prior to our visit we made inquiries of at least a dozen collectors who should have been familiar with the locality relative to the present possibilities for minerals and in each case were advised: "It is not worth a visit." In spite of these discouraging replies our interest in visiting the old locality was not dampened in the least.

On March 12, 1938, Dr. J. R. Evers and the writer made Atlanta, Ga., our headquarters for a few days during which time nearby localities were visited. By good fortune we contacted Mr. C. D. Gibson, Head of the Department of Geology, Georgia School of Technology, in Atlanta, who with Mrs. Gibson made our visit a most enjoyable one. Through arrangements made by Mr. Gibson, we were privileged to see the very fine collection of minerals at the State Museum early Sunday morning, March 13th, when the Museum was closed to the public. From the specimens on display here we obtained much valuable information on the localities of Georgia. Mr. and Mrs. Gibson also took us by car to Stone Mountain, that huge dome-shaped mass of granite which rises to an elevation of 686 feet above the surrounding lowland plain and has a basal circumference of approximately 7 miles[1] from whose quarries very fine fluorescent hyalite has enriched many a collection. Prof. J. W. Lester of Emory University, a member of the party, who had made a number of trips to Graves Mountain, very kindly drew for us a sketch of the latter locality showing how it could be reached and where minerals could be found.

History

Graves Mountain first came into prominence in 1859 when Prof. Charles Upham Shepard[2] announced

1 Granites of the Southeastern Atlantic States by T. L. Watson, U.S. Geol. Sur. Bull. 426, 1910, p. 210.

2 Shepard, Charles Upham. *On Lazulite, Pyrophyllite and Tetradymite in Georgia.* Am. Jour. Sci. 2nd series, Vol. 27, pp. 36-39, 1859.

Graves Mountain, Ga., view looking north-northwest.

the presence of lazulite, pyrophyllite and rutile in a published report in the *American Journal of Science.* According to Prof. Shepard, a Dr. Stephenson of Lincoln County, Georgia, sent to Mr. S. Harris of Allatoona, Ga., a small blue crystal which he wanted identified. Mr. Harris in turn showed the crystal to Prof. Shepard who was visiting him. It was immediately recognized as lazulite. Investigation then showed that pyrophyllite, cyanite, rutile and other minerals were also present.

Prof. Shepard stated that gold occurred in the quartzite of the mountain and that mining for the precious metal had been carried out to some extent. The workings, however, were very small—a few insignificant pits.

It was rutile, however, which made the mountain famous. At least two good sized pits, or trenches, had been made on the north slope in search of specimen material. Kunz[3] reported that the rutile from this locality had realized at least $20,000 in cabinet specimens which supplied collections all over the world.

Dr. George F. Kunz, who before his death in 1932 was president of Tiffany & Company, Jewelers, of New York City, owned the top of Graves Mountain which embraced the rutile-bearing area. Whether or not he had work done on the pits is not known to the writer but he did allow some of his friends to prospect the locality on a 50-50 basis. The property may still belong to the Kunz estate.

PHYSIOGRAPHY

Johnson[4] states: "Graves Mountain is an asymmetric monadnock rising 400 feet above the surrounding countryside. It is about 1 mile long from northeast to southwest and less than half a mile wide. The north and east sides rise gently; the south and west sides are steep. Viewed from the southwest end, quartzite crags stand out against the timber-covered slope. Capping the monadnock are two summits separated by a saddle. The altitude of the higher summit is 901 feet, and the average altitude of the surrounding land is 500 feet."

GEOLOGY

The rock of the mountain is a fine-grained quartzite, chiefly white, which when weathered is so soft that it can be crushed with ease with the fingers. Indeed in hammering out specimens the quartzite powders so easily that

3 Kunz, George F. *History of the Gems Found in North Carolina.* North Carolina Geological & Economic Survey, Bull. 12, p. 52, 1907.

4 Johnston, W. D., Jr. *Kyanite at Graves Mountain.* Geological Survey of Georgia. Bull. 46, Atlanta, 1934, p. 26.

the sand proves a nusiance as it flies all over one. This easily crumbling of the quartzite has given it the name "sugary quartz".

Watson and Watson[5], who have examined the area thoroughly say: "The basal portion of the mountain and for some distance up the slope on the northwest side the rock is the foliated variety quartzite schist, while the crest and for an undetermined distance down the slopes the rock is massive quartzite, with a tendency to schistosity indicated. This latter phase (massive) of the quartzite has been designated by Shepard the rather rare variety known as itacolumite. On top of the mountain the quartzite is cut by quartz veins, some of the larger ones of which measure several feet in thickness. These do not appear to have been crushed or brecciated and are apparently barren. Similar quartz veins only a few inches wide contain rutile and iron oxide. The rock from some of the small openings shows fracturing and brecciation.

The quartzite schist is light in color when fresh but is very generally discolored at the surface some shade of red by iron oxide from weathering. It is composed of quartz and less sericite as the essential minerals, with cyanite and occasionally small grains of rutile and black oxide of iron as the principal accessory minerals.

The massive quartzite which occurs on the crest and higher slopes of the mountain has essentially the same composition as the quartzite schist. It is compact in texture and light, nearly white, in color when fresh, but near the surface it is friable, easily crumbling into a loose sand under pressure of the hand and is a buff color, due to the presence of some iron oxide. It is fine grained in texture, composed largely of fine sugary quartz, some muscovite, and in places contains abundant large and small tables of cyanite of pale green color when fresh, crystals of blue lazulite and small grains of red rutile. Pyrophyllite is rather common. Cyanite, lazulite and rutile are usually intimately associated, the first two (cyanite and lazulite) are frequently embedded one in the other and the rutile occurs as separated grains and as inclusions in the other minerals. The weathered surface of the rock is quite rough and, when examined in detail, the more resistant minerals, lazulite and cyanite, stand out in relief. Alteration of the columnar crystals of cyanite to muscovite is often pronounced. Weathering has partially discolored the cyanite a brownish yellow from free hydrous oxide of iron also to some extent the lazulite but the most noticeable effects in the latter minerals are the dulling of luster and lightening of color."

LOCATION

Graves Mountain is in the southwestern part of Lincoln County within less than a mile of the Wilkes County line; furthermore the locality is approximately ¾ of the distance between Washington and Lincolnton —about 12 miles east of Washington (the county seat of Wilkes Co.) and 40 miles northwest of Augusta. Lincoln County is in the northeastern corner of the state and is bordered on the east by the Savannah River which separates Georgia and South Carolina. Perhaps the location of Graves Mt. can be more accurately given by stating it is 33°-44'-30" North Latitude and 82°-31'-30" West Longitude.

5 Watson, Thomas L. and J. Wilbur. *A Contribution to the Geology and Mineralogy of Graves Mt., Ga,* Univ. of Va. Publication. Bulletin of the Philosophical Society, Scientific Section, Vol. 1, No. 7, Jan. 1912, p. 207.

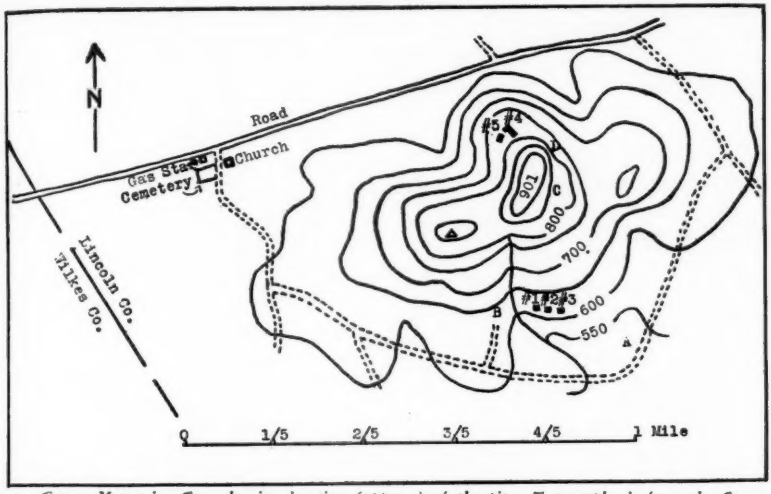
Courtesy Geological Survey of Georgia.

Map showing location of Graves Mountain, Ga.

As in all we have read concerning the minerals of Graves Mt., nothing has been said regarding the roads to it. We have thought it well, therefore, to record rather minutely how we reached the locality to which we shall refer herein.

We drove 5 miles east of Washington, turned left on a dirt road which 6 miles further became a macadam road. We had traversed only a few miles on the dirt road through very level country when we began to see a mountain in front of us which gradually became higher and higher as we neared it. The terrain was practically level so that this mountain, the only one in the area, was very noticeable. The area appeared to be sparsely settled and when we reached the mountain no one was around of whom we could inquire as we were not exactly certain if it was Graves Mountain. An abandoned gas station and a small church were near its approach (½ mile in on the macadam road). The mountain appeared heavily wooded and was more extensive than we had supposed. So we continued on the road until we came to a dirt road that turned off to the right which we took as it wound around the east slope of the mountain. We followed it for about ¾ mile where we stopped at a small shanty to inquire directions of some colored women. We learned that the mountain was Graves; that the road we were on led to a hunting clubhouse; that they knew nothing about either the minerals which had made the mountain famous, or its pits. But they did tell us that the dirt road which turned off toward the church continued beyond it and might be the one we wanted; we had thought the road led only to the church.

So we turned around and retraced our route back to the church and abandoned gas station. We turned



Graves Mountain, Ga., showing location (approx.) of the pits. Topography is from the Crawfordville Quadrangle, Ga.-S. C. Map of the U. S. Geological Survey.

A triangulation station is located on the highest point of its southwest summit. A letter from W. C. Mendenhall, Director of the U. S. Geological Survey, informs us that the geographic position of the station mark is recorded as Latitude 33° 44′ 23.214″, longtitude 82° 31′ 39.013″, based on the 1927 North American Datum, now standard. The approximate altitude for the surface of the ground at the station is 850 feet above sea level.

left, went past the church and a small cemetery and about 3,500 feet further noticed a poor road leading off to the left for the mountain. We turned in on this road, went about 200 feet and stopped as the road ended in what appeared to be a small picnic ground. As we were about as close to the mountain as it was possible to drive, we parked the car and proceeded on foot.

We approached the mountain from the foot of its southern slope. Unconsciously we turned to the right, crossed a small brook which flowed down the slope, from the saddle as we later noticed, and soon ran across three small pits. Pit #1 was 25x5x5 feet deep; 50 feet to the east was Pit #2, 10x6x10 feet deep; 100 feet further east was Pit #3, 100x5x5 feet deep. All were dry and nothing of interest was found at any of them. These, evidently, were the pits that had been dug for gold.

We then proceeded to climb the steep southern slope, via a path. All up the slope, for about 700 feet, the path was strewn with broken fragments of minerals, chiefly milky quartz much of which was stained by iron, but pyrophyllite and cyanite were also plentiful. A few outcrops were present and they gradually increased on the way up until near the crest of the mountain they were very conspicuous. And what outcrops! Very bold, rugged and of the most fantastic and weird forms and shapes imaginable! We never saw their like before! Smoke was rising near the top of the mountain which we soon saw came from a wood fire but not a soul was around. The writer had to pinch himself more than once to make sure he was not dreaming because of

the unusual formations, the stillness of the air, and the fire, he might be in Satan's kingdom or the Devil's Den. On investigation, we found that the weird appearance of the rocks was due to weathering. These weathered rocks, forming huge crags, occupied the extreme top of the east summit.

Approximately 500 feet from the summit and at the foot of the north slope of the crest where the ground flattened, two more pits were seen. The larger, #4, was L-shaped, 150 feet long, 10 feet wide at one end and 25 feet at the other, 8 feet and dry. About 100 feet west was the other pit, #5, 50x15x8 feet deep and dry.

The terrain of the area was well open as no bushes were present and leaves and shrubs had been burnt off though the slopes were fairly well wooded with small trees. The soil of the mountain was dark brown in color. The rocks were heavily coated with lichens.

The five pits described were the only ones seen by us; the west summit was not examined. Prof. Lester[6] informs us, however, that as far as he knows there are at least two pits on the west summit. They are really trenches, then pits, and were dug, apparently, as cross cuts in an effort to trace rutile.

Along the eastern crest of the mountain we found our best specimens of rutile imbedded in the solid rock. Lazulite was also found here. It was Dr. Evers who first found rutile. Prior to his find the mineral appeared very rare as no specimens could even be seen. But after the first find the mineral became very common. It was present as small, lustrous black crystals in pyrophyllite and was especially numerous close to the contact of the quartzite though none was found in the quartzite itself. A number of large crystals, about ¾" in diameter, were also found. Because rutile was especially prevalent in very small crystals, it was at first unnoticed. But when Dr. Evers stumbled upon a beautiful large crystal in an exposed rock, in extracting it, the smaller crystals were discovered. We thus became familiar with its occurrence, so that other finds were made easily. Indeed in a narrow, vertical crevice, in one large rock, at least 100 lustrous crystals, all small, were visible but they were too difficult to extract and so were left alone.

Lazulite was the last mineral of importance to be found and we almost left without it. Prof. Lester's sketch indicated that it was present along the eastern crest but though we searched diligently had difficulty in locating it. Just as we were about to admit our failure and leave, as it was getting dark, the writer spied a few bluish markings on the side of a small vertical "cliff" and—they were the lazulites. The mineral, as tiny crystals, was in sugary quartzite which was so crumbly that large pieces would break off with ease. So fragile was the quartzite that specimens containing lazulite seemed almost unobtainable. We did, however, picked out some of the more solid material which miraculously survived the journey home. So numerous were the lazulite crystals in the one mass broken up and so easily did they fall out of the quartzite that one could have gathered hundreds of them, loose and perfect though very small.

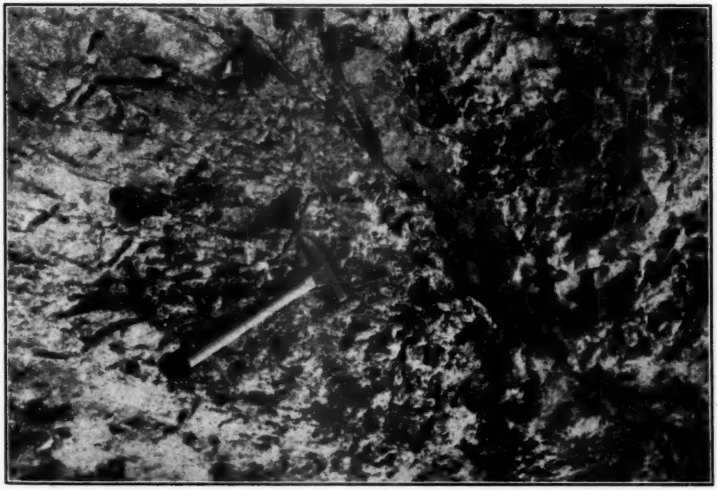
MINERALOGY

The following minerals occur on Graves Mountain:

Barite: No specimens were found by

6 Personal communication.

A—Cyanite—impregnated quartzite forming crags on the southwest end of Graves Mountain.



Courtesy Geological Survey of Georgia.

B—Detail of Plate A showing the distribution of the kyanite.

the writer but Shepard[7] reported the mineral to occur here. He stated that "Small drusy cavities very rarely occur in the itacolumite pretty nearly filled with barytes (barites), massive and crystalline. Very minute and perfectly formed transparent crystals of quartz are discernible in the barytes, likewise microscopic crystals of sulphur."

Biotite: Prof. Lester[8] informs us that the mineral occurs in little tablets in some of the small pegmatites near the base of the slope on the east summit.

Cyanite (Kyanite): Next to quartz this is the most abundant mineral as it is widely distributed throughout the quartzite. Commonly it is present in huge masses of interlaced tabular plates (appearing cellular) and coated brown so that it resembles an altered or a pseudomorphous mineral. Parts of it may show its original green or blue color; while black lustrous rutile crystals may fill its interstices.

It is further present as tiny pale bluish flakes in unaltered quartzite giving the latter a bluish-gray color. It is also present in large flakes and tabular crystals, pale bluish, in sugary quartzite.

Sometimes the exposed surface of cyanite is black, inside it is dark reddish-brown, then yellowish-brown and finally greenish-blue in its interior. Scattered among such a multicolored mass would be small plates of greenish-blue gemmy cyanite.

The resistance to weathering of cyanite cause the exposed rocks to assume very fantastic shapes—cellular, rounded, eroded, etc.

Gold: This metal was not suspected by the writer to be present as no printed notice of its occurrence had been noted by him prior to his visit to the locality. It was on perusing Shepard's report that its presence was noted. Shepard[9] stated that gold occurred in traces in the itacolumite, especially near the southern extremity of the formation, where it becomes more schistose and embraces minute crystals of pyrite. The gold had been mined, many years ago, to a limited extent.

Hematite: Black botryoidal masses were picked up near pit #4, Red fragments were scattered over the mountain. Hematite is also common as reddish stains on cyanite and pyrophyllite. It is also present in deep black lustrous platy masses associated with limonite and cyanite.

Shepard[10] said that the hematite is massive, granular (approaching compact) but the masses are somewhat open, from including the decomposing ferruginous kyanite, particles of pyrophyllite and even portions of compact rutile. The large masses consequently possess a some-what, slag-like and roughened aspect and suggest on being handled the presence of some native metal.

Johnson[11] states: "Weathered quartzite from open cut in the saddle of the mountain contains hematite and some specimens, particularly those containing rutile crystals, are composed chiefly of granular hematite. It seems reasonable to infer that the widespread development of hematite in the monadnock is the result of weathering of equally widespread pyrite. Botryoidal and reniform hematite, of apparently secondary or-

7 Shepard, op. cited, p. 38.
8 Personal communication.

9 Shepard, op. cited, p. 37.
10 Shepard, op. cit., p. 37.
11 Johnston, op. cit., p. 28.

igin, is abundant in the cornfield on the north slope."

Ilmenite: Several specimens of vein quartz containing large tabular crystals of ilmenite were found on the north slope of the mountain, but none was observed in place.[12]

Loose crystals are on display at the State Museum in Atlanta. No specimens were found by the writer.

Lazulite: Johnston [13] reports finding on the south slope "a number of exposures of weathered quartzite containing numerous lazulite crystals three-quarters of an inch or less in length with the lazulite in abundant kyanite. The lazulite appears to be confined to a zone 2 or 3 feet wide, and all the observed exposures fall on a line striking N. 30° E., up the hillside toward the saddle. It was not possible to determine whether or not this strike was determined by a bedding plane. As quartz veins transact this zone without marginal enrichment, they do not appear to account for the distribution of the lazulite."

Tiny sky-blue pyramidal crystals were found disseminated in a sugary quartzite. Some of the faces of the lazulite are encrusted by a thin whitish mineral as if it were an alteration.

The quartzite in which lazulite is imbedded is so soft and crumbly that large masses can be broken up with the hands and the lazulite crystals extracted with ease; indeed it is somewhat difficult to get good specimens due to the fragility. Gilbert W. Withers, however, has sent us a large, beautiful specimen of lazulite in quartzite, the quartzite being so tough that a hammer would be necessary to break it. From what part of the mountain this specimen came from, he did not inform us.

The fresh quartzite is of a creamy-pink color but that exposed to the atmosphere is coated by a minutely thin grayish-black stain, which often is encrusted by lichens. Nevertheless, the lazulite crystals projecting out of this stained, lichen-encrusted quartzite appear to be of good quality, unstained, unaltered.

Shephard[14] said: "Lazulite exhibits a tendency to form nests and bunches. That within a few feet of the surface, its rock is loose and sandy and presents a pale buff color, but at a depth of 3 feet, it approaches compactness with a grayish white color. The lazulite is almost wholly in crystals varying from a ¼ to 1 inch in length, and are scattered like garnets through granite or mica slate, presenting a very pleasing appearance from the contrast between the ultramarine blue of the mineral and the clear, pale buff of the rock."

Kunz[15] stated "The finest crystals come from Graves Mountain, Ga., some of them being as much as two inches in length."

Twinned crystals of lazulite are said to occur here but none were seen by the writer.

Limonite: "There is much limonite in both the quartzite and the kyanite. Commonly weathered kyanite crystals are coated with a brown mixture of sericite and limonite having the superficial appearance of weathered sericite."[16]

Common as brown stains on minerals; also as black masses, sometimes associated with hematite; also as brownish earthy masses with granular

12 Johnson, op. cit., p. 28.
13 Johnson, op. cit., p. 29.
14 Shepard, op. cit., p. 37.
15 Kunz, op. cit., p. 37.
16 Johnson, op. cit., p. 28.

hematite.

An iridescent specimen is on display at the State Museum, Atlanta.

Muscovite, var. Sericite: Noted as pearly flakes with and often on cyanite in sugary quartzite; it is an alteration product of the cyanite.

Psilomelane: Reported as occurring here but none seen by the writer.

Pyrite: Tiny, lustrous grains and cubes were seen in a tough, unaltered, bluish-gray quartzite near pit #5. The quartzite looked bluish because of the minute flakes of bluish cyanite imbedded in it.

Pyrophyllite: "It forms radiating fibrous aggregates a quarter of an inch in diameter, of pearly luster when fresh or shades of yellow and brown when iron-stained. In croppings on the southwest and south sides of the mountain the pyrophyllite occupies veins cutting the quartzite."[17]

The mineral is very soft and varies from tiny veins in sugary quartzite, also in cyanite, to huge masses of radiated material which often appears banded due to iron. In a banded type, pyrophyllite will have a thin brownish crust underneath which may be a thin creamy-color band, then 3 inches of red to be underlaid by sugary quartzite in abundance. Such a banded specimen is easy to break open as the quartzite powders readily.

The presence of iron give pyrophyllite a variety of colors ranging from yellowish to brown to deep red, and it is these shades of color that add to the very weird appearance of the fantastically eroded rocks. Sometimes exposed weathered surfaces of pyrophyllite have the appearance of weathered serpentine.

17 Johnson, op. cit., p. 29.

Quartz (Blue): A small specimen was received from Mr. Withers which consists of tiny bluish grains of quartz in a granular rock which is so deeply stained by limonite that its identity could not be ascertained even with a hand lens.

Quartz, var. Milky: "The quartzite is cut by innumerable quartz veins ranging in width from less than 1 inch to 10 feet or more. The vein quartz is white, translucent and vitreous in appearance.....The contact between vein quartz and quartzite is generally sharp. Bladed kyanite and minute rutile crystals occur in the quartz."[18]

Quartz fragments are common all over the mountain.

Tiny milky quartz crystals, poor in quality, were noted on massive milky quartz.

Quartz var. Rock Crystal: Tiny rock crystals, poor in quality, were noted on stained massive milky quartz.

Shepard[19] said: "Occasionally small imbedded crystals of quartz of the form of those found in the Trenton limestone of New York are seen in the kyanite."

Rutile: The finest rutile crystals, black and lustrous, found by us were imbedded in pyrophyllite. Tiny crystals were noted in brownish cyanite. No rutile was noted in quartz or in quartzite.

Very fine crystals, in matrix, also loose (2 inches in size) are on display at the State Museum, Atlanta. A loose 4 inch crystal is in the mineralogical museum of Harvard University,

Mr. Withers sent us a nice specimen consisting of a lustrous rutile crystal

18 Johnson, op. cit., p. 28.
19 Shepard, op. cit., p. 37.

associated with black granular hematite and cyanite; another was of rutile crystals with cyanite in iron-stained quartz.

Shepard[20] stated that gigantic rutile crystals, weighing upwards to a pound and possessed of much regularity of crystalline form, were found here. That the most perfect crystals were imbedded in the massive kyanite.

Kunz[21] stated: "At Graves Mountain, Ga., elegant rutile occurs with lazulite usually imbedded in a compact red oxide of iron that can be readily removed by hydrochloric acid, or with a sharp instrument, leaving on the surfaces a mirror-like polish. The crystals vary in length from ½ an inch up to 5 inches, and are either single, twins, or vierlings often in fine groups."

Johnston[22] reports: "Graves Mountain is famed for the size and perfection of its rutile crystals, and in the last century several trenches were made just below the saddle on the north side in search of specimen material. Loose rocks from the trench highest in the saddle yielded highly lustrous sharp-faced crystals of small size. Larger crystals with more or less rounded edges are abundant on the slopes below the trenches, particularly in the cultivated fields on the north side of the mountain where fresh colluvial material is exposed each year by plowing. The largest crystal found during my visit measured 1½x2 inches and was once twinned. Many multiple twinned crystals were collected here in the last century. Rutile, in minute crystals, was present in all thin sections examined as inclusions in vein quartz, kyanite, and lazulite."

20 Shepard, op. cit., p. 36.
21 Kunz, op. cit., p. 52.
22 Johnston, op. cit., p. 28.

Watson[23] and Watson reported red rutile as occurring here.

Sulphur: See Barite.

Turgite: Lustrous black botroyoidal masses on limonite.

CONCLUSION

Our visit to Graves Mountain proved that the locality was far from being exhausted and that it was well worth a visit. Of course if one could do a little digging and blasting he would undoubtedly uncover some very fine rutiles, pyrophyllites, and lazurites. Perhaps, some day, a professional collector or dealer may rework the area so that once again its fine minerals may be made available for collectors.

ACKNOWLEDGMENT

The writer wishes to acknowledge his great indebtedness to Mr. and Mrs. C. D. Gibson for their very kind hospitality while he was in Atlanta and for the trouble they took to make it possible for him to become more familiar with the minerals of their state. Also to Prof. J. W. Lester for the map he made and for the information given us regarding Graves Mountain; to the Division of Mines, Mining and Geology, State Capitol, Atlanta, Ga. (Capt. Garland Peyton, Director) for loan of plates to illustrate this article and other valuable assistance; to Dr. G. W. Crickmay, Associate Professor of Geology, University of Georgia, for many valuable suggestions; to Gilbert W. Withers, of Atlanta, Ga., for the large assortment of Graves Mountain minerals recently sent us; and to Dr. J. R. Evers who was my congenial companion on this trip.

23 Watson and Watson, op. cit., p. 208.

EARLY BRAZILIAN SLAVE MINING

By ALLAN CAPLAN

The large gold production of Brazil of the seventeenth and eighteenth centuries may be credited to the Portuguese; but actually, it was the thousands of African slaves who toiled daily towards this objective. Ouro Preto, one of the oldest cities of Brazil and the first capital of the state of Minas Geraes, owes its origin to this cause. The many churches, the huge iron-barred prison, and the ancient governor's palace (now the School of Mines) are relics of the past, still maintaining their orginal haunted atmosphere.

The surrounding hills in a semi-arid climate have yielded much gold to the primitive black men. The small stream flowing through the elevated valley may yield to this day placer gold and even platinum when sufficient water is present. Most of the year, however, the stream bed is generally dry, and consequently, it is not worked.

The method of gold extraction by the Portuguese pioneers is revealed by exploring and studying the ruins of the vegetated rock-walled structures both in the valley and on the mountain slopes. A series of huge tanks resembling prison walls approximately forty by sixty feet each causes one to wonder about their purpose. Upon detailed investigation along the slopes, a system of thickly walled ditches, dams, and even tunnels comes to light. The ditches, which are five feet wide, can be traced far back on the distant mountains as they ascend towards the summit, appearing like a line on the face of a low rolling mountain. Some ruins of dwellings were discovered beneath bushes and ferns growing luxuriously during the present rainy season. Against the wall of one structure rested a huge slab of schist 4'x12x5" in which pits were worn, evenly spaced, on both sides of the slab. Without a doubt, it was used by the toiling blacks to grind by hand the piles of rich oxidized ore of their master.

The ferruginous quartz, which averages an ounce to the ton, lies scattered over the hills, and can be easily traced to its source. Veinlets and seams in schist exist over the entire vicinity. Because the material was easy to work by hand, a large production of ore was easily obtained by the combined efforts of the Africans. Long bat-infested tunnels and drifts penetrate into the heart of the mountain. Not one of these exposed a strong vein as required by modern mining methods. For the slavers, it was an ideal situation, for they scattered the hundreds of slaves in the numerous rich outcrops and drifts.

The manner by which the gold was extracted from the easily crumbled ore was original and adopted to fulfill the demands of seasonal rainfall and natural occurrence of the gold. Without slave labor such a primitive method of operation could not be profitable.

The newly mined material was ground by hand upon slabs of rock similar to the one discovered. The coarsely ground ore was then dumped into one of the numerous rock-walled vats and accumulated. Water from the ditches was permitted to enter and was well mixed with auriferous material. Finally, the vat contents were then flushed by a flood from the ditch to be washed over sluice boxes or

other means of gold separation. Each vat was worked in the same fashion; for when one was being filled, another was being mixed with water, and still another was going through the flushing procedure. Lack of water in the long ditches caused washing operations to cease until rains in the vicinity caused the ditches to fill once again. It was necessary, however, to catch the drainage of the mountain slopes for miles around, and to bring this accumulation through the ditches and tunnels to the tanks in the valley below.

Vast mounds of quartz, too hard for grinding, exist below the huge mixing vats. These piles range from one-half to an ounce in gold to a ton. Without a doubt these tremendous piles of "waste" expose the very low percentage of extraction, excluding the loss obtained by inefficient grinding. Yet the recoverable gold built fortunes for the Portuguese land-barons, for the loss in extraction caused them no worry as long as quantity was easily mined.

The days of prosperity for slave holders came to an end about the time of our Civil War. Without the cheap and plentiful labor of the slaves, it was an impossibility to operate this property. Granted their liberty the hordes of blacks sought easier means of existence. Many of them continued gold mining independently, far from their original homes. Others turned to agriculture and other occupations to be absorbed throughout the generations with the white settlers and native Indians into a new and distinct race of people.

A FRIENDLY SUGGESTION.

Here is a bet worth not passing up by Rocks and Minerals Association members living within a reasonable distance of New York City. There are many hiking clubs in the metropolitan area, most of which have regular weekly wood walks scheduled for Sundays, and some for other days. In some cases the clubs have definitely planned nature walks along trails in the wilder regions; and the leaders of all the clubs, in seeking out the more fascinating spots of wilderness country, are continually arranging trips which include visits to old mines, forgotten or never known by most collectors, but still encompassed by dumps from which interesting material may be garnered. In general, the clubs are hospitable to visitors. Their schedules are published for a month or so ahead in *Walking News,* a little monthly periodical, which is issued at the ridiculously low and merely nominal rate of thirty cents a year. It can be ordered of William Hoeferlin, 556 Fairview St., Brooklyn, N. Y. One trip to an old mine, such as may often be visited on the hiking trips, will more than pay for the trifling investment. Having profited myself from association with a couple of the hiking clubs named in the publication, I am glad to pass along this lesson of personal experience. Hikers and mineral collectors make mighty good pals, and have much in common, and plenty of information as to hitherto unregarded mineral or rock localities worth visiting may be casually picked up from hiking companions. Try this out, and you will thank me for the tip.

JAMES F. MORTON.

ROCKS AND MINERALS ASSOCIATION MEETING

(PRELIMINARY ANNOUNCEMENT)

Sat. June 17th, 1939

9:00 A.M. - 6 P.M.

With a World's Fair on either side of the continent this year, it has been decided that the outing planned for 1939 will be an inning; in other words it will be in the nature of a convention which will be held in the auditorium of the Administration Building of the Peekskill Military Academy, Peekskill, N. Y., Sat., June 17th.

The tentative program will consist of registration at 9:00 a.m., to be followed by a business meeting, addresses and movies (mineralogical), interrupted by luncheon in the dining hall at 12:30 p.m., and a social gathering from 4:00 to 6:00 p.m. Through the courtesy of the Trustees and Principals of the Peekskill Military Academy, we are privileged to use their auditorium and dining hall as the school then will be closed for the summer vacation.

The Peekskill Military Academy, which is well-known throughout the United States and in many of the foreign countries, is over 100 years old, having been founded in 1833. It is the first school or academy in the United States, outside of West Point, to give military instructions to its students. The grounds upon which it is situated are historical and in the angle of the main building on the north campus is a gigantic oak from a limb of which a British spy was hung during the Revolutionary War. Among its graduates have been many eminent men among whom might be mentioned: Hon. Chauncey M. Depew; Gen. Henry T. Allen, who was in command of the American Army of Occupation in Germany after the World War; Admiral Harris Laning; James B. Ford, Vice-President, U.S. Rubber Co., whose benefactions to the Academy were many in after years including the Ford Administration Building in which our meeting will be held.

As the Academy's Campus is a very extensive one, extending as far south as Depew Park, an opportunity can be afforded for walks into the park itself where many fine outcrops of the Cortlandtown series of rocks may be viewed and examined. The chief rock of the Cortlandtown series is norite (gabbro) and the entire series have been of intense interest to geologists. The campus covers the contact of the series with Manhattan schist.

Those desiring to attend the meeting must notify the Secretary by June 10th of their intention to be present and send in their check to meet the cost of the luncheon and registration fee. We MUST know in advance how many are to be provided for at the luncheon, so inform the Secretary at your earliest if you will attend and how many will be in your party. Tickets for members and guests are $1.25 each.

It is hoped that at this, our first meeting, we may have members present from distant states who may have come east to visit the World's Fair in

New York City, at this time of the year.

Every subscriber to ROCKS AND MINERALS is a member of the Rocks and Minerals Association and we would like to see a large number of them present at the meeting. Your presence at the meeting will not only stimulate your interest in mineralogy but will also give you the opportunity to meet and become acquainted with other members, some of whom may even reside in your city or vicinity.

Furthermore, the Academy has beautiful buildings and grounds and Peekskill itself is a beautiful city so that your visit to the meeting should prove a most interesting and an enjoyable one.

A more detailed program for the day will be printed in the June issue of ROCKS AND MINERALS.

PETER ZODAC, *Secretary,*
Rocks and Minerals Association,
Peekskill, N. Y.

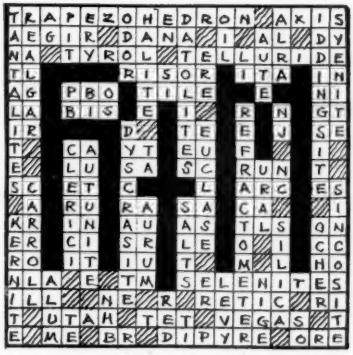
AN ODD MINERAL

It looks like lard—it feels like butter—it cuts like cheese—yet it is a mineral that can't be melted!

The material possessing these striking properties has been received at Field Museum of Natural History as a gift from Mr. Ben Hur Wilson, a member of the Rocks and Minerals Association, of Joliet, Ill. Mr. Wilson reports that it came from a locality near Agate, fifty miles from Barstow, California, where it is being worked for use in the ceramics industry. The mineral has locally been called "Eyrite," derived from the name of its discoverer, but preliminary study in the museum laboratory by L. Bryant Mather, Jr., assistant curator of mineralogy, indicates that it is sufficiently similar to saponite to be classified as a variety of that species. Chemically it is a hydrous silicate of magnesium with about 20 per cent water, and small amounts of lime, fluorine and alumina. When the mineral is heated, the water is given off and the lard-like appearance of the specimen is changed to a chalk-like one.

It is distinguished from its distant relative sepiolite (better known as "Meerschaum") from which fine pipes are carved, and which is likewise a hydrous magnesium silicate by several tests. The most striking of these is its failure to display that characteristic property of sepiolite of adhering to the tongue.

Buy your specimens and supplies from established dealers—in other words buy from dealers advertising in ROCKS AND MINERALS.



Last month's Crossword Solution.

A MINERALOGICAL CROSSWORD PUZZLE

By WALTER P. SACHS

ACROSS

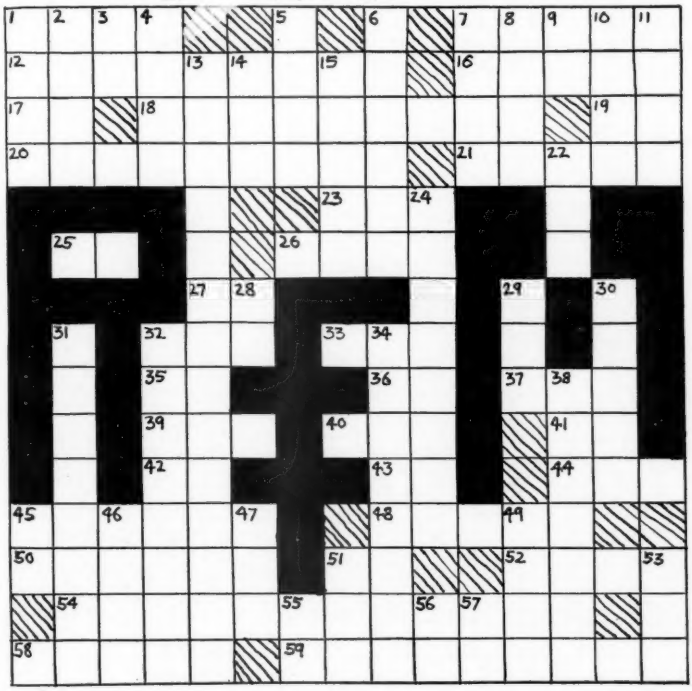
1—Principal metal derived from the ores of Franklin, N. J.
7—State noted for tourmalines.
12—A hydrous manganese silicate from Oriente Province, Cuba.
16—Author of a work on phases of mineralogy, published in Vienna in 1873; first name was Franz.
17—Two common ingredients of the atmosphere (symbols).
18—A hydrated silicate of manganese and iron, mainly derived from the alteration of rhodonite and other manganese silicates.
19—Osmium (symbol).
20—Name proposed for the isomorphous series of orthorhombic pyroxenes including enstatite and hypersthene.
21—Three elements of the four composing adamite (symbols).
23—Three terminal letters of another name for uranotil.
25—Yellow precious metal (symbol).
26—Province of Canada where, near Edmonton, platinum has been found (abbreviation).
27—Erbium (symbol).
32—Composition of sphalerite, in reverse order (formula).
33—Midwestern state where fluorite has been mined (abbreviation).
35—Tellurium (symbol).
36—That is (abbreviation).
37—A precious stone.
39—The three elements which go into the composition of becquerelite (symbols).
40—First three letters of the name of a zeolite of the mordenite group.
41—State where extensive deposits of galena are found (abbreviation).
42—Thallium (symbol).
43—Height (abbreviation).
44—Greek for 'dawn," from which is derived part of the geological term "Eocene."
45—South American country, once an important producer of diamonds.
48—In Norse mythology, the god of the stormy sea, after whom a silicate of sodium and iron has been named.
50—Usually first in an index of minerals, a variation of the name of a mineral intermediate between niccolite and breithauptite.
51—Bromine (symbol).
52—Adjective which could be used to describe a mineral, valuable because of its uncommonness.
54—In the tetragonal system of crystallography, a term describing a double eight-sided pyramid.
58—Metal-bearing vein (plural).
59—Czar of Russia after whom was named a variety of chrysoberyl.

DOWN

1—Crystallographic term which includes a series of faces on a crystal whose intersection-lines are mutually parallel.
2—The most important metal.
3—Nickel (symbol).
4—Coin containing mainly copper.
5—Two elements essential in the composition of a titano-silicate (symbols).
6—Pertaining to the present geological epoch.
7—Prefix from the Greek used in mineralogical nomenclature to denote resemblance.
8—Imaginary line around which crystal faces are symmetrically arranged (plural).

9—Indium (symbol).
10—A gaseous element.
11—Erbium, sulphur, oxygen (symbols).
13—Name variation descriptive of natrolite (plural—two words).
14—A measure of weight for ores.
15—Word used before the name "refractometer."
22—Two elements composing the oxide, baddeleyite (symbols).
24—Name under which Xonotlite from Santa Ynez, Calif., and from Isle Royal, Mich., was described.
28—Radon (symbol).
29—Part of descriptive name given calcite in acute scalenohedral form: "—— tooth spar."
30—Three elements composing the molybdate, wulfenite (symbols).
31—State where so-called "Salida garnets" are found.
32—A rare silver telluride from Nagy-Ag, Roumania.
34—Artificial lead monoxide.
38—Highly prized variety of beryl.
45—Barium (symbol).
46—Adjective describing lack of H_2O.
47—Non-mineralogical; "to rent."
49—Asiatic country, said to have little-exploited deposits of iron and copper.
51—Boron, aluminum (symbols).
53—A human organ, sometimes used by women as support for gems.
55—Radium (symbol).
56—Domestic bovine quadruped, non-mineralogically speaking.
57—Sodium (symbol).

References Dana's Textbook of Mineralogy, 4th Edition, by W. E. Ford. A System of Mineralogy, 6th Edition, by E. S. Dana.



THREE LOCALITIES IN NEW BRUNSWICK, CANADA

By ALVIN LUKASHOK

After two weeks of preparation, studying of geological and road maps, and the asking of information from various Boards of Trade, a party of eight boys, including the writer, and three counselors, set off, by automobile, for New Brunswick, Canada, from Camp Modin, Canaan, Maine.

The trip was to be a five day one, leaving camp early on a Monday morning and returning late the following Friday afternoon. Though we were eager to see anything of natural interest, our main purpose was a mineralogical one.

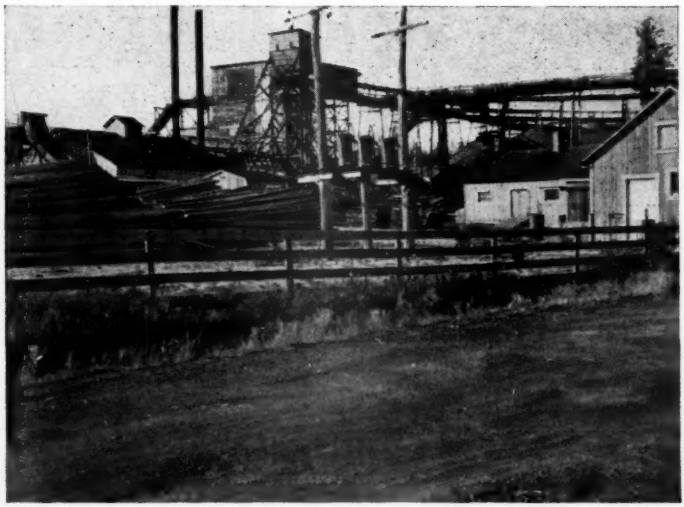
Our first mineral location was reached late Tuesday afternoon. Its precise location was given to us by the Secretary of the Woodstock Board of Trade. It was an old, abandoned copper mine that was reputed to have excellent pyrite specimens. To reach it we crossed the St. John River from Woodstock, in western New Brunswick, turned right and followed the highway until we came to a dirt road leading up to a small farmhouse. Here we parked our cars, 1½ miles from the bridge. The mine was reached after walking about ½ mile over pasture land. When we saw the mine we were at first disappointed as it did not look promising for minerals. But we began to search in the small waste pile and were soon pleasantly surprised for the specimens that we began to find were of excellent quality. The pyrite crystals ran up to ¾

Lake George Antimony Mine, near Prince William, N.B., with one of its waste piles in background.

of an inch in size. Galena and chalcopyrite were plentiful and very interesting. After we had gathered our fill, we left, and then continued our journey towards Fredricton, the capitol of the Province of New Brunswick.

Early Wednesday morning, before Fredricton was reached, we arrived at Lake George, Prince William (25 miles from the Capitol), where we were told that there was an excellent antimony mine in the neighborhood. Directions for reaching the mine were given us and in no time at all we were there and its extensive waste dumps delighted us considerably. Though the mine had been abandoned for fifteen years, the machinery in a large building at the shaft was still in good condition. It appeared as if the ore, stibnite, was loaded on the cars in the shaft and sent up to the second floor of the building where the waste was separated from the ore and thrown out through two windows, for below these two windows the waste piles were so large and high that one could walk out on them from either window. Strangely enough the waste piles were lacking in good specimens but due to the curiosity of one of our party who found sacks full of ore, we obtained many excellent stibnites. Native antimony, jamesonite and kermesite also occur here but we were not successful in finding any of them.

From the antimony mine we continued on to Fredricton where we visited the University of New Brunswick. There we saw an excellent collection of minerals and fossils at the University's Museum. From one of the professors, we obtained information about two coal mines in the Minto District which interested us



The Rothwell Coal Mine near Mints, N. B.
Note shaft in center background.

greatly.

We had time only to visit one of the coal mines. This was a bituminous mine (Rothwell Mine) where many fossils were said to occur, and it is located between Minto and Grand Lake in southern New Brunswick. On our arrival, we met Mr. E. Benton Evans, owner and manager, who informed us that the mine was closed down for the day as during the summer the miners work only three days a week. Even though he was inconvenienced, Mr. Evans kindly consented to take us into the mine and to show us around. To descend into the workings, 50 feet below, we used a narrow stairway. The walking through the drifts and passageways of the mine was very uncomfortable as we had to bend almost double so as not to bruise our heads. Mr. Evans explained that as the miners were paid only for the actual coal mined, and as the coal vein was very narrow, 2½ feet at the most, the men did not trouble themselves to remove more rock (shale) than was necessary; this accounted for the shallowness of the passageways.

Mr. Evans further informed us that the miners work always on their knees even when there was enough head room. All through the passageways were tracks on which the mine cars, loaded with coal or shale, were pushed out to the shaft. Two bare copper wires were strung through every passageway for alarm. The current in these wires was only 6 volts in order that the men would not receive a shock should they touch them. The coal was so soft and crumbly that it was useless as specimens and so none was taken. But when the surface was reached, we all rushed for the waste dumps to hunt for fossils and our efforts were rewarded by the finding of some excellent specimens. The fossils were leaves and stems of ferns, the leaves being of better quality and more plentiful. One of the stems found was almost 12 inches in diameter.

After packing away all of the fossils that we had collected and thanking Mr. Evans for his many courtesies, we continued our journey to St. John. This was our last stop as from here we headed back for camp. The trip was a most pleasant and enjoyable one and we were all delighted with it. The largest and finest specimens that we had collected were donated to the Camp's Museum; the smaller ones being retained by the finders.

The writer wishes to express his thanks to Mr. Herbert Pomerantz, the leader of the party, because it was through his efforts that the trip was so successful.

ODDITIES IN INDUSTRIAL MINERALS FORM SUBJECT OF LECTURE

An exhibit of strange industrial minerals such as mineral cork, mineral jelly, synthetic mineral lumber, mineral cellophane, flexible rocks, rocks that float, mineral fibers and cloth, laboratory quicksand, and featherweight brick has been shown and discussed in a lecture given by O. C. Ralston, Chief Engineer, Nonmetals Division, of the Bureau of Mines, United States Department of the Interior, in the University of Maryland-Bureau of Mines series, on Tuesday evening, March 28, at 8:15 p.m., in the College of Engineering Auditorium at College Park, Maryland.

WHAT'S WRONG WITH MINERAL COLLECTING?

(Continued from page 130)

long since carried away by earlier collectors. So they bring home with them an overload of material, after each trip to a locality, and in a short time the amateur collector acquires an assortment of junk—dirty, odd-shaped, valueless, unlabeled, "specimens" which are generally stored away in shoe boxes or dumped into barrels and tucked away in the cellar, under the porch, or up in the attic. True these "specimens" cost the collector nothing, but the collection is worth even less and the time may come when he may even have to pay a man to cart it away. It may have been fun to collect common, ordinary material which a mineral dealer would have discarded as worthless, and the amateur collector may not perhaps have wasted his time altogether, but on the other hand, he has not acquired anything of value.

The uninformed amateur collector should be corectly guided at the very start. He should be told that in order to have a good collection of minerals, one which would give him many hours of pleasure and satisfaction, it should consist of fine specimens, accurately labeled and nicely displayed.

The easiest and cheapest way of acquiring such a fine collection is to purchase specimens from established mineral dealers. Be assured of this. The most noted collectors of the country do this and likewise all museums. Specimens obtained from established mineral dealers are of good quality, accurately labeled and reasonably priced. A collector should make regularly monthly purchases, even if only a few dollars worth at a time, and of the better grade, if possible—50c to $5.00 per specimen. At the end of a year or so he will have a collection of which he may well be proud. He will want to display it to its full advantage in some attractive cabinet and even to show it to his many friends and acquaintances some of whom in turn may become fascinated with mineralogy and will want to have collections of their own. The specimens will furthermore be an incentive to know more about them and the collector will want to acquire a good book on minerals and read up on their occurrences, where found, and how they may be identified.

Collect at localities whenever you can as we do not mean to discourage this, but pick out only the best specimens to add to your collection. In time, through the study of your purchased specimens and comparing your own collected material with them, you will acquire a discrimination and knowledge which will not only add to your pleasure in collecting in the field but will lessen the burden you will bring home with you.

Mineral collecting is a most fascinating hobby but unless the amateur collector starts off in the right manner he may never get the enjoyment and satisfaction which should be his. At the very start he should get an assortment of good specimens which are accurately labeled. Then he should read up on the specimens and gradually add more to them. If he does this his interest in minerals will never fade and his thoughts may concur with those of many collectors that one of the satisfactions in this world is the enjoyment that the subject gives those who love mineralogy.

Peter Zodac

Graves Mountain Minerals

ATTENTION COLLECTORS AND MUSEUMS!

It is a pleasure to announce that due to arrangements having been made with the owners of Graves Mountain, in Lincoln Co., Ga., I now have two men working the area for mineral specimens. Once again, therefore, will this world-famous locality be made to yield its very fine rutiles, lazulites and pyrophyllites to enrich collections all over the world. It has been many years since this locality was last worked and as Graves Mountain minerals have been practically unobtainable for some time, I have, therefore, arranged to supply specimens to the thousands of new collectors who have sprung up within recent years.

Hundreds of very fine specimens have already been secured and are now offered for sale. Here is your opportunity to acquire a suite of choice Graves Mountain specimens at very reasonable prices.

Rutile: Crystals, 3/8 to 1 1/4 inches, loose and in matrix of radiated pyrophyllite, platy hematite and brown cyanite. The brilliancy and beauty of the black Graves Mountain rutiles is not approached by those of any other locality. 2x2-3x4 inches, $1.00 to $5.00. Museum specimens $10.00 to $25.00.

Lazulite: Sky-blue, doubly terminated crystals in quartzite, 2x2-3x4 inches, $1.00 to $3.00. Museum specimens $10.00 to $25.00. A few specimens of twinned crystals in quartzite, 2x2-3x4 inches, $2.00 to $5.00.

Pyrophyllite: Radiated, yellow to brown in color, 2x2-3x3 inches, 75c to $2.00. Museum specimens $3.00 to $5.00.

Pink Corundum from Clay Co., N. C., small gemmy crystals and crystal fragments free of matrix, $1.00 per oz. In matrix of actinolite, 2x2 inches, $1.00.

Postage extra on all orders. Estimate 15c on every $1.00 order and any amount left over will be returned you in stamps, or better specimens will be sent.

GILBERT W. WITHERS

Southeastern Mineral Specimens

P. O. Box 928 **Atlanta, Georgia**

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